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| 09/875,464      | 06/05/2001  | Ping Tak Peter Tang  | 42390P11196         | 6268             |

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EXAMINER

DO, CHAT C

| ART UNIT | PAPER NUMBER |
|----------|--------------|
| 2124     |              |

2124

DATE MAILED: 02/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

|                               |                                      |  |
|-------------------------------|--------------------------------------|--|
| Application No.<br>09/875,464 | Applicant(s)<br>PETER TANG, PING TAK |  |
| Examiner<br>Chat C. Do        | Art Unit<br>2124                     |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1)  Responsive to communication(s) filed on \_\_\_\_\_.
- 2a)  This action is **FINAL**.
- 2b)  This action is non-final.
- 3)  Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4)  Claim(s) 1-29 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5)  Claim(s) \_\_\_\_\_ is/are allowed.
- 6)  Claim(s) 1-29 is/are rejected.
- 7)  Claim(s) \_\_\_\_\_ is/are objected to.
- 8)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9)  The specification is objected to by the Examiner.
- 10)  The drawing(s) filed on 05 June 2001 is/are: a)  accepted or b)  objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11)  The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a)  All   b)  Some \*   c)  None of:  
1.  Certified copies of the priority documents have been received.  
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1)  Notice of References Cited (PTO-892)
- 2)  Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3)  Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4)  Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5)  Notice of Informal Patent Application (PTO-152)
- 6)  Other: \_\_\_\_\_

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### DETAILED ACTION

1. This communication is responsive to Amendment filed 10/08/2004.
2. Claims 1-29 are pending in this application. Claims 1, 12, and 13 are independent claims. In Amendment, claims 3-4, 14-15, and 25 are amended. This Office action is made final.

#### *Drawings*

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the limitation in claim 28 must be shown or the feature(s) canceled from the claim(s), in particular the hardware architecture that is pipelined as claimed to significantly improve over prior art. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet"

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pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 1, the term "can be" in line 9 is a relative term which renders the claim indefinite. The term "can be" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For examination purposes, the examiner disregards the term "can be". Claims 12 and 23 have the same rejection.

Thus, claims 2-11, 13-22, and 24-29 are also rejected for being dependent on the rejected base claims 1, 12, and 23 respectively.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-2, 12-13, and 23-24 are rejected under 35 U.S.C. 102(b) as being anticipated by the admitted prior art.

Re claim 1, the admitted prior art discloses in Figure 1 a computer-implemented method for approximating a function of an input argument (page 1 lines 3-8) comprising: selecting one of a plurality of breakpoints (page 1 lines 14-16) such that a reduced argument for the function is less than a predetermined value (page 1 lines 16-17); and evaluating an approximate function of the reduced argument (Figure 1), including accessing a look-up table (108) based on the selected breakpoint ( $B_j$ ) to obtain a value of a term in the approximate function ( $\log_b(1/B_j)$ ), wherein the look-up table has at least one breakpoint for which the reduced argument can be computed without round off error when the input argument is close to a root of the function (108 with the look-up table).

Re claim 2, the admitted prior art further discloses in Figure 1 the function is  $\log_b(x)$  (Figure 1 capture).

Re claim 12, it is an article of manufacture claim of claim 1. Thus, claim 12 is also rejected under the same rationale as cited in the rejection of rejected claim 1.

Re claim 13, it is an article of manufacture claim of claim 2. Thus, claim 13 is also rejected under the same rationale as cited in the rejection of rejected claim 2.

Re claim 16, it is an article of manufacture claim of claim 5. Thus, claim 16 is also rejected under the same rationale as cited in the rejection of rejected claim 5.

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Re claim 23, it is a computer system claim of claim 1. Thus, claim 23 is also rejected under the same rationale as cited in the rejection of rejected claim 1.

Re claim 24, it is a computer system claim of claim 2. Thus, claim 24 is also rejected under the same rationale as cited in the rejection of rejected claim 2.

Re claim 28, the admitted prior art further discloses the processor has a hardware architecture that is deeply pipelined (page 2 lines 15-18) and in which branch mispredictions cause a significant performance penalty (inherently).

### *Claim Rejections - 35 USC § 103*

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 3-5, 9-10, 14-15, 20-21, and 25-26 are rejected under 35 U.S.C. 103(a) as being obvious over the admitted prior art.

Re claim 3, the admitted prior art discloses in Figure 1 representing X in the floating point form  $Y * G^k$  where Y is greater than or equal to 1 (page 1 lines 9-11), and wherein the reduced argument is  $Z = (Y * B_j - 1)$  where C is a function of  $\log_b(e)$  ( $p_0$  in 124 in Figure 1), and evaluating the approximate function (116) includes determining  $\log_b(1/B_j)$  using the look-up table and determining  $\log_b(X)$  as an arithmetic combination of at least  $k * \log_b(2)$ ,  $\log_b(1/B_j)$ , and  $\log_b(1 + Z/C)$ . The admitted prior art does not disclose the reduced argument is multiplied with C as  $C * (Y * B_j - 1)$ . However, it is known

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in the art that a same computation can be executed in any order in a process as long as it does not change the result of output as seen in the admitted prior art in Figure 1 wherein the core approximation compute  $p_0R$ . Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the reduced argument as  $C*(Y*B_j-1)$  as lightly seen in the admitted prior art in Figure 1 because the processes are equivalent.

Re claim 4, the admitted prior art further discloses  $Y \leq 2$  and the look-up table is modified such that  $B_0 = 1$  and  $B_N = \frac{1}{2}$  (page 1 lines 14-16).

Re claim 5, the admitted prior art further discloses  $\log_b(1/B_j)$  is given by the look-up table as at least two lower precision values  $T_{j,hi}$  and  $T_{j,x}$  whose sum equals  $\log_b(1/B_j)$  (first line of 108),  $\log_b(2)$  is given by at least two lower precision values  $L_{j,u}$  and  $L_{j,o}$  whose sum equals  $\log_b(2)$  (second line of 108), and  $Z$  is given by at least two lower precision values  $Z_{i,u}$  and  $Z_{i,o}$  whose sum equals  $Z$  (104).

Re claim 9, the admitted prior art further discloses the predetermined value is proportional to  $1/(2*N)$  (page 1 lines 14-16).

Re claim 10, the admitted prior art further discloses  $k*L + T$  can be represented without roundoff error for all valid values of  $k,j$  (108 by table).

Re claim 14, it is an article of manufacture claim of claim 3. Thus, claim 14 is also rejected under the same rationale as cited in the rejection of rejected claim 3.

Re claim 15, it is an article of manufacture claim of claim 4. Thus, claim 15 is also rejected under the same rationale as cited in the rejection of rejected claim 4.

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Re claim 20, it is an article of manufacture claim of claim 9. Thus, claim 20 is also rejected under the same rationale as cited in the rejection of rejected claim 9.

Re claim 21, it is an article of manufacture claim of claim 10. Thus, claim 21 is also rejected under the same rationale as cited in the rejection of rejected claim 10.

Re claim 25, it is a computer system claim of claim 3. Thus, claim 25 is also rejected under the same rationale as cited in the rejection of rejected claim 3.

Re claim 26, it is a computer system claim of claim 5. Thus, claim 26 is also rejected under the same rationale as cited in the rejection of rejected claim 5.

10. Claim 29 is rejected under 35 U.S.C. 103(a) as being obvious over the admitted prior art in view of Intel Corp. ("Chapter 2: Introduction to the IA-32 Intel Architecture").

Re claim 29, the admitted prior art fails to disclose the processor is one of a plurality of IA-32 series of processors by Intel Corp. However, the Intel Corp. discloses the architecture of IA-32 series of processors. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the processes in the IA-32 processor as seen in Intel Corp.'s invention into the admitted prior art because it would enable to optimize the pipelined and branch instructions (page 2-7 lines 8-10).

#### *Response to Arguments*

11. Applicant's arguments filed 10/08/2004 have been fully considered but they are not persuasive.



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- a. The applicant argues in page 7 first paragraph for drawing of claim 28 that the processor in Figure 5 as a key component having the pipelined hardware architecture would overcome drawing objection as made in previous Office action.

The examiner respectfully submits that the key limitation cited in claim 28 is the pipelined architecture to significant improve the performance when implement the approximating a function of an input argument. Since the mathematical algorithm of the invention is very complex and it would not easy for an ordinary skill in the art to recognize and construct the pipelined architecture of the algorithm.

Therefore, the limitation in claim 28 must be shown in drawing or the feature(s) canceled from the claim(s), in particular the hardware architecture that is pipelined as claimed to significant improve over prior art.

- b. The applicant argues in pages 8-9 for claim 1 that mainly the admitted prior art does not have the lookup table has a breakpoint for which the reduced argument can be computed without round off error, when the input argument is closes to a root of the function.

The examiner respectfully submits that there are several points that the admitted prior art clearly meets all the limitations cited in claim 1: 1) claim does not require or limit the input argument to any specific range close to the root of the function, therefore any input argument reasonably close to one would meet; 2) the admitted prior discloses the absolute input argument for the right side of Figure 1 larger than  $1+\delta$  ( $\delta = 2^{-4}$ ), this input argument is reasonably close to the root

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of 1 of the function; 3) Figure 1 of the admitted prior art clearly discloses a table (108) containing a break point for at least one of absolute input argument that is larger than  $1+\delta$ ; 4) the paragraph [005] in page 2 clearly disclose the benefits of right side path of Figure 1 that would produce without roundoff error. Based on the above points, the examiner believes the reference by the admitted prior art clearly meets all the limitations cited in the claim therefore it anticipates claim 1.

*Allowable Subject Matter*

12. Claims 6-8, 11, 17-19, 22, and 27 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

*Conclusion*

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chat C. Do whose telephone number is (571) 272-3721. The examiner can normally be reached on M => F from 7:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaki Kakali can be reached on (571) 272-3719. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chat C. Do  
Examiner  
Art Unit 2124

February 10, 2005



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